

A combined four transmission lines flat speaker

Using the Fe127e.



This model has been designed and tested by Jacques Candé

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Design philosophy

Main features

- Full range concept, a single driver shall cover the audible range to a maximum extent, (45Hz to 15 kHz at ± 2 dB targeted)
- Diffraction effect minimised by placing the speakers against the listening room wall
- Stiff non resonant box

Implementation

- The Fe 127E driver proposed in the FOSTEX catalogue was apparently capable to cover the targeted range, (simulations of a column design yield correct output level down to 40 Hz).
- A flat concept was apparently possible within still reasonable dimensions, $60 \times 60 \times 12$ cm³ that could accommodate four identical transmission lines.
- The complex pattern of the inner walls needed to generate the four transmission lines results into a very efficient rib stiffened structure.

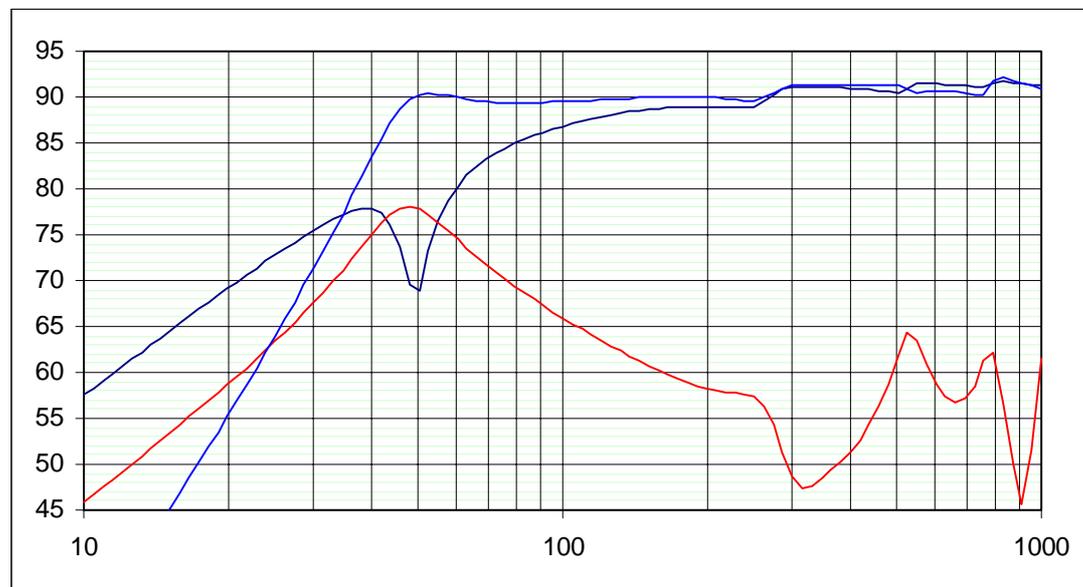
Theoretical acoustic performances

A math model describing the driver coupled to the four identical transmission lines was specially created.

The physical properties of the driver were those specified by the manufacturer.

The transmission lines were modelled with the formulation proposed by M.J. King.

The expected frequency response at 1 meter for 1 watt input (8 ohm) is as follows



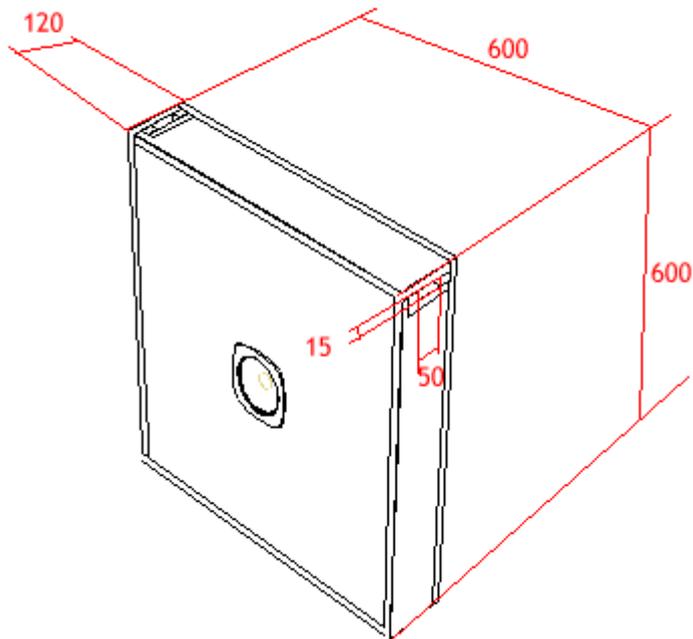
Black is the driver direct radiation

Red is a single port radiation

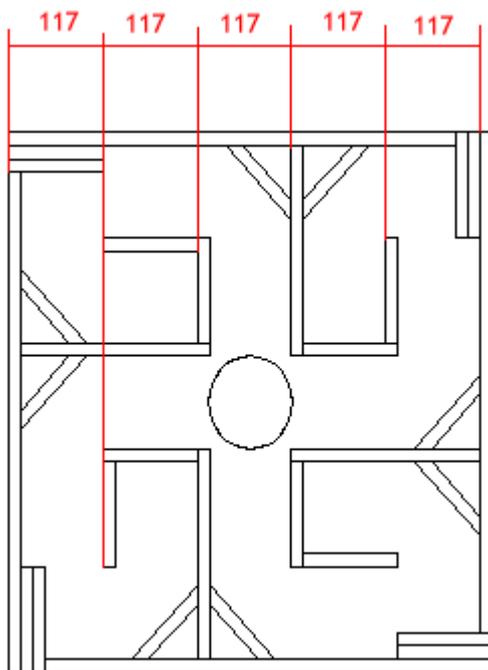
Blue is the combination of the driver's direct radiation combined with that of the four ports.

Drawings

General outside view, (all dimensions in mm)



General inside view, (all dimensions in mm)



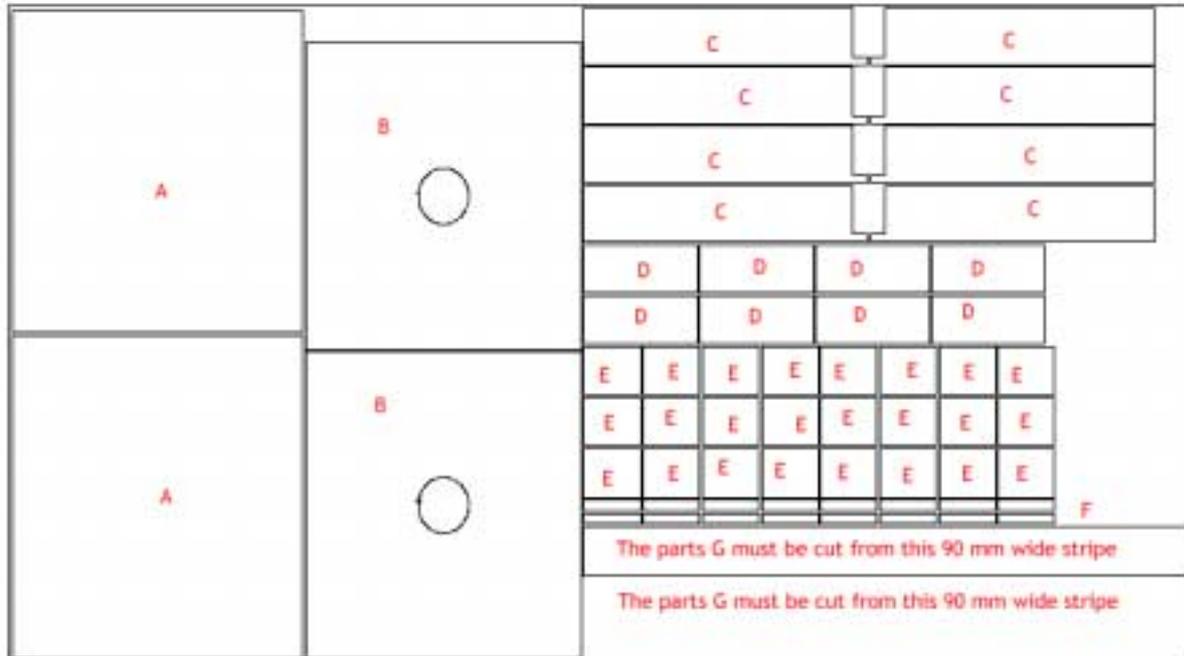
Part list

All the parts are made of 15 mm thick birch plywood, dimensions are in mm

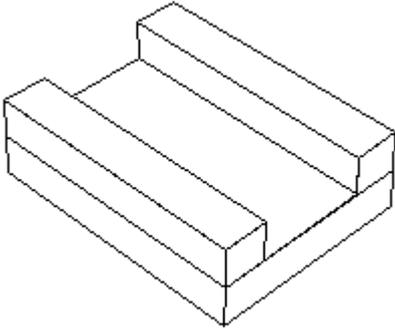
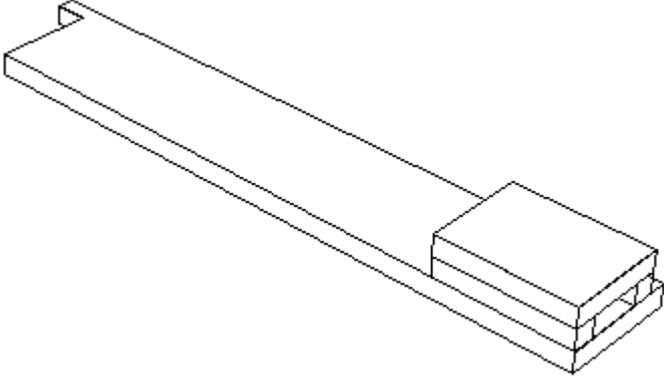
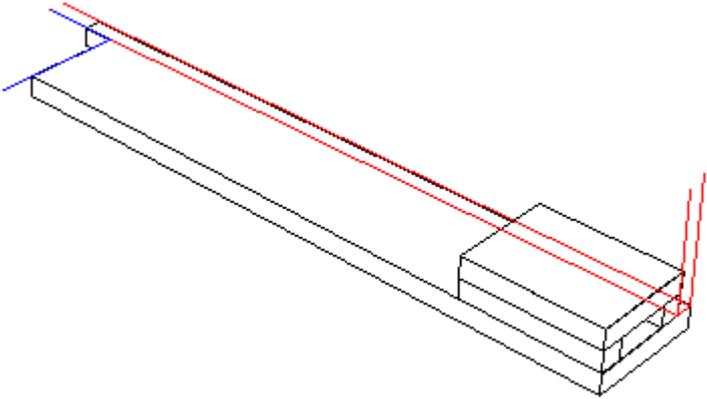
The number of parts specified in the following table are required for two speaker boxes

Part name	Part reference	Dimensions	Number of parts
Back panel	A	600 x 600	2
Front panel	B	570x570, (104 mm diameter cut-out for the driver)	2
Side panels	C	585x105, with 30x90 cut	8
Long inner walls	D	234x90	8
Short inner wall	E	117x90	24
Port sides	F	117x20	16
Bevelled panels	G	118x90 45 degrees cuts	16

The parts are cut from a 15 mm thick birch plywood panel whose dimensions are: 1220x2440 mm²



Step by step construction

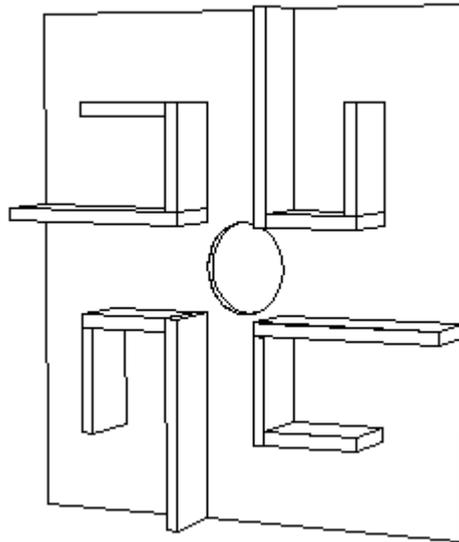
<p>Port assembly</p> <p>1 part E 2 parts F</p> <p>8 port assemblies are required</p>	
<p>Side assembly</p> <p>1 port assembly 1 part C</p> <p>Nota Bene: The pair of speakers requires 2 symmetrical units. Two symmetrical groups of 4 side assemblies are necessary, (mirror symmetry)</p>	
<p>Side assemblies</p> <p>The blue cut-out 90x30 fits the adjacent port assembly</p> <p>The red lines identify the location of the front panel in the final assembly</p>	

Front panel assembly

1 part B
4 parts D
8 parts E

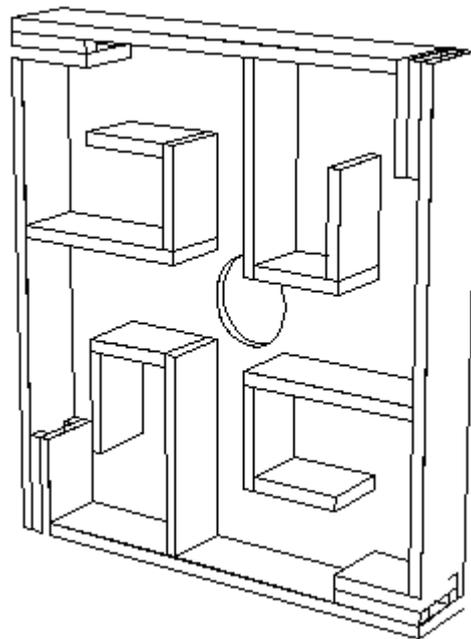
Nota Bene:

The pair of speakers
requires 2 symmetrical
front panel assemblies
(Mirroring Symetry).



Adding the 4 side panels

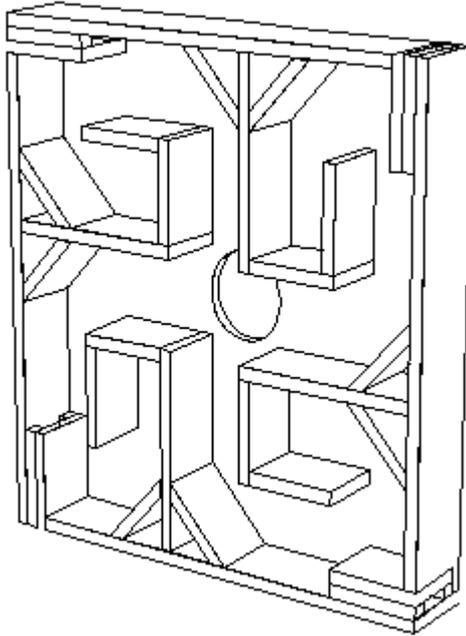
The 4 side panel
assemblies are added to
the front panel assembly



Adding the 8 bevelled panels

The bevelled panels, (part G) are 118 x 90 overall.

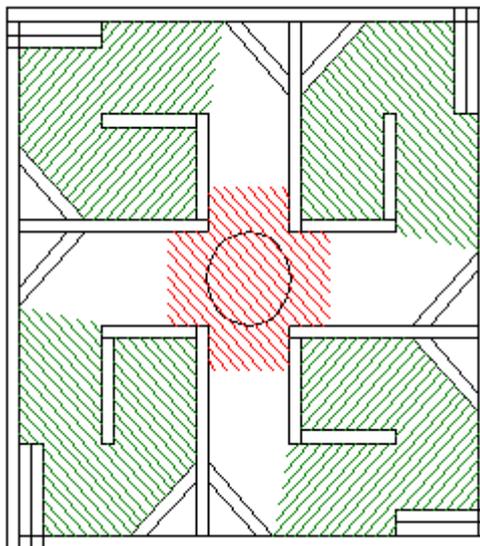
It is advised to add a line of silicone filler (used normally for plumbing) to all the joints in order to ensure appropriate tightness.



Adding the damping material

 Polyfill to be added before closing the back panel

 Prepare a 30 cm span cross made of wool felt to be fit to the back panel inner side once the box has been closed. Trim according to taste



Listening impression/ measurements

No measurement made so far.

The first impression given by this model is clarity and transparency.

The second impression is impact.

The third impression is presence of the low frequency

The very stiff front panel eliminates certainly a lot of structure vibrations. The acoustic design of the transmission lines reinforces the low frequency range but does not interfere with the driver signal at higher frequency. As a result there are no conflicting additional sonic sources.

The driver is at the exact centre of the four ports. Port and driver signal are perfectly in phase. Consequently the two waves coming from both sources combine perfectly for a maximum effect. The apparent point source is always the driver.

The transmission line gives sufficient low frequency response down to 47 Hz.

These speaker are very good on any kind of music.

Even a huge orchestral mass is detailed. Voices are superb. The bass frequency output gives realism to live records. Small jazz groups play in your room. Brass instruments are shiny, rosin is heard on the strings, and when Parker blows his horn, one may hear him taking his breath.

Drawbacks

The visual size of the speaker looks enormous. It will be the showstopper in many cases.